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# Biological Review of the 1993 Texas Closure

by

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## Introduction

In 1981, the Gulf of Mexico Shrimp Fishery Management Plan (FMP) was implemented with the primary objective being to increase the yield of brown shrimp harvested from Texas coastal waters. Since then, various aspects of the Texas closure management measure have been analyzed and reported on by scientists at the Southeast Fisheries Science Center (SEFSC). This report contains an overview of selected effects of the 1993 Texas closure and will be presented to the Gulf of Mexico Fishery Management Council in January 1994.

## Background

The Shrimp FMP regulates fishing for brown shrimp in the Exclusive Economic Zone (EEZ) off the coast of Texas. This regulation prohibited brown shrimp fishing in the total EEZ (200 mile closure) during the periods: May 22-July 15, 1981; May 26-July 14, 1982; May 27-July 15, 1983; May 16-July 6, 1984; and May 20-July 8, 1985. In 1986, 1987 and 1988, only the portion of the EEZ from 9 to 15 miles was closed to fishing. In 1986, the area was closed May 10-July 2, while in both 1987 and 1988, the Texas offshore waters were closed from June 1-July 15. In 1989, the 200 mile closure again went into effect and has remained in effect every year since that time. Closure periods were June 1-July 15, 1989; May 15-July 8, 1990; May 17-July 6, 1991; May 15-July 6, 1992; and May 15-July 6, 1993. State of Texas regulations, implemented in 1960, prohibited shrimp fishing in the territorial sea off Texas during these same periods, except for the white shrimp fishery from the beach to the 4 fathom depth line. In 1990, however, state law prohibited all shrimping activities including the 4 fathoms daytime fishery. This same law was in effect during the 1991 through 1993 closures.

The management objectives of the Texas closure regulation (as specified in the FMP) are to increase the yield of brown shrimp and eliminate the waste of the resource caused by discarding undersized shrimp caught during a period in their life cycle when they are growing rapidly. The objective of the 1960-1980 Texas territorial sea closure was to manage the fishery so that a substantial portion ( $\geq 50\%$ ) of the shrimp in Gulf waters had reached 65 tails/pound or 112 mm in length by the season's opening. Thus, the temporary closure of the offshore

fishery from mid-May to mid-July each year provides larger shrimp to the fishery and subsequently a higher market value.

## Methods

Port agents collected statistics on the catch, effort, and fishing location of shrimp vessels operating in the Gulf of Mexico. These data provided information on the species, size and location of shrimp, as well as information on the catch rates and fishing efforts of the vessels in the fleet.

## Conclusions

### 1. Recruitment

Based on the Galveston Bay, Texas, postlarval and juvenile brown shrimp 1993 indices of abundance, models predicted that the brown shrimp season, from July 1993 through June 1994, would yield approximately 26.8 million pounds off the Texas Coast. This value was below the 1960 through 1991 average of 27.3 millions pounds. Louisiana biological indices showed that juvenile shrimp abundance in the inshore and nearshore areas were below average in May, suggesting below average recruitment and a below average year. Based on these low values, models predicted a May 1993 through April 1994 inshore and offshore catch in Louisiana of only 18.8 million pounds. However, early biological indications in June showed that a strong late recruitment was probably underway which improved prospects for a near average year in Louisiana. Thus, the western Gulf of Mexico should expect a combined annual brown shrimp production that is only moderately below the 56.2 million pound average.

Maximum recruitment of postlarval brown shrimp into Texas and western Louisiana estuaries occurs during February through early April. A wide array of environmental and biological factors affect the fate of these young shrimp. Salinity, temperature, and water height have been identified as important factors affecting the survival, growth and abundance levels of subsequent offshore populations. The amount of useable nursery area appears to be related to the distribution of favorable salinities as well as to the tidal water height in marshes.



Bay water temperatures exceeding 68° F in April and May are also favorable for above average shrimp production.

The spring of 1993 was one of the coolest in the past decade with average air temperatures in April of 66.9° F. These cooler temperatures inhibited shrimp growth rates for postlarval shrimp entering Texas and Louisiana bays. Rainfall amounts were not as high as the spring of 1992, but exceeded the historical average, resulting in lower salinities in the estuarine marsh habitats. Water heights during late April and early May were above average and provided young shrimp with better access to feeding areas in marsh nurseries. Postlarval shrimp abundance was below average in early spring of 1993 with only 5.5 postlarvae per tow was recorded during sampling.. The average is 28.4 postlarvae per tow. The 1993 level was, however, approximately three times higher than observed in the spring of 1992.

## 2. Fishing Trends

### Louisiana

The May through August 1993 catch in Louisiana for inshore waters amounted to 10.2 million pounds, with 80% of the total catch during May and June. This year's inshore production was well below average for the month of May (only 0.1 million pounds), but only slightly below average for the entire May through August period (Table 1).

In 1993, May inshore production was only 0.1 million pounds with June production at 8.1 million pounds. Catch levels dropped quickly after June, with a July catch of only 1.8 million pounds and an August catch of 0.3 million pounds.

In May 1993, the Louisiana offshore fishery produced 2.3 million pounds of brown shrimp. Unlike most years, the majority of the catch occurred only in the shallow waters of statistical subarea 13 (Figure 1). CPUE values were low in all subareas (200 - 300 pounds per day).

In June, the fishery off Louisiana produced 4.8 million pounds of brown shrimp with a fishing effort of over 22,000 days. The average CPUE value was

219 pounds per day. CPUE values were low (200 - 250 pounds per day) in most statistical subareas (Figure 2). When compared to May, more of the catch took place further offshore in each of the five statistical subareas (13-17).

In July, the offshore fishery in statistical subareas 13-17 produced 4.2 million pounds of brown shrimp with an effort of about 6,600 days of fishing (Table 2). Average CPUE was 635 pounds per day. CPUE values were lowest in subareas 13 and 14, moderate in subareas 15 and 17, and highest in subarea 16 (Texas subareas not included in this discussion) (Figure 3). Most of the catch was in water shallower than 10 fm in all statistical subareas.

In August, the Louisiana offshore fishery produced approximately 2.2 million pounds of brown shrimp with an effort value of 4,900 days. Average CPUE was only 444 pounds per day. Catch levels (CPUE) were high in statistical subarea 15 and were moderate in all others (Figure 4).

Overall during the May-August 1993 period, 13.5 million pounds of brown shrimp were landed from the offshore Louisiana fishery. This catch level is about average when compared to most years since 1981 (Table 1). The catch resulted from a high expenditure of effort. A total of nearly 36,500 days of fishing occurred during this four month period off Louisiana. Average CPUE was 370 pounds per day. During the May through August period, sizes of landed shrimp were mainly in the >67 count size class (Figure 5). This is similar to past years.

## Texas

In Texas bays, from May through August 1993, 6.1 million pounds of brown shrimp have been landed (Table 1). This represents an above average catch value from Texas inshore waters when compared to other levels since the closure began in 1981. Monthly catches during 1993 were greatest in May and June with 1.9 million pounds in May and 2.9 million pounds in June. These two months accounted for 79% of the catch during the four month period. Landings in July were 1.3 million pounds landed, and dropped off quickly in August with about 20 thousand pounds landed.



The 1993 offshore catch from May through August amounted to only 10.0 million pounds with 9.2 million pounds (92%) of the catch produced in the July through August period (Table 1). The four month total catch for this year was the worst since closures began in 1981 (Table 1). During the July through August period the size composition of landed shrimp changed from 64% in the >41 count size groups in July to around 40% in the >41 count size groups in August (Figure 6). In previous years the volume of shrimp in the >41 count size groups in July was around 36%. Thus, smaller than average shrimp were landed during July 1993, when compared to the same period in previous years.

In May 1993, about 0.8 million pounds of brown shrimp were landed with an effort of around 2,400 days fished. This produced a CPUE value of 315 pounds per day. CPUE values generally increased in magnitude from north areas (subarea 18) to south areas (subarea 21). Subarea 21 had the greatest CPUE value (Figure 1).

With the entire EEZ closed to shrimp trawling, the June catch was only 7,000 pounds. This value is low compared to those of most other June periods during 200 mile closure years. Effort could not be calculated for the area and average CPUE was not estimated. Catch was low in all statistical subareas (18-21) (Figure 2).

Total catch in July was 5.2 million pounds with only 7,100 days fished. This is a below average catch for the month of July, with effort levels also lower than normal (Tables 1 and 2). CPUE during the July period was 729 pounds per day fished (Table 2). This is the second year that the July CPUE value has been below 1000 pounds per day following a 200 mile closure. CPUE was highest in subarea 21 (Figure 3). The greatest catch occurred in the 11-20 fm depth off statistical subareas 18, 19, and 21 (Figure 3).

In August, the offshore Texas catch was 4.0 million pounds of brown shrimp with an effort of about 8,200 days of fishing. CPUE was around 497 pounds per day. Catch was low, but effort values were moderate when compared to other August values. CPUE was at an all time low level when compared to other August values (Table 2). As in years past, most catch was concentrated in subarea 19 (Figure 4). All subareas off Texas experienced moderate CPUE

values, with subareas 20 and 21 having the best at around 570 pounds per day (Figure 4).

### 3. Distribution of Catch From Texas Waters

Some concern has been expressed that the distribution of landings following the Texas closure has changed in recent years. To evaluate this problem, the Texas catch (all shrimp species) during the May through August period was partitioned by port of landing. Landing locations were summarized into five general groups. These groups included lower Texas ports (Port Mansfield, Aransas County, Riviera, Nueces County, Port Isabel and Brownsville), middle Texas ports (Brazoria County, Matagorda County, Calhoun County, Refugio County, Port Lavaca, Matagorda, Palacios, Port O'Connor and Seadrift), upper Texas ports (Jefferson County, Chambers County, Galveston Island, Harris County and Kemah), Louisiana ports (all Louisiana ports), and other ports (ports from Mississippi, Alabama, Florida and the U.S. east coast).

As discussed in last years report (Nance, 1992 Texas Closure Report to GMFMC), the shrimp catch from Texas waters and distribution of landings to various ports throughout the Gulf of Mexico has not significantly changed since 1977. Distribution values this year were not much different than in past years (Figure 7). Lower Texas ports seem to have the greatest percentage of the landing at around 48%. This is followed by the middle Texas ports (29%) and then the upper Texas ports (17%). This relationship seems to maintain itself during both 15 mile (1986-1988) and 200 mile closure years (1981-1985, 1989-1993). Overall, about 94% of the catch from Texas waters is landed in Texas ports.

### 4. Shrimp Landings by Port

The distribution of shrimp landings in Texas ports was examined to determine if changes had occurred since the initial closure in 1981. May through August Gulf-wide shrimp catch was summarized by port of landing. During the May through August period about 35% of the shrimp caught in the U.S. Gulf of Mexico is landed in Texas ports. This distribution has not changed to any great



extent during the 13 years of closures (high in 1991 of 43.7%, low in 1986 of 30.1%) (Figure 8).

For distribution of Texas landings by individual Figure 9 shows landings of the five upper Texas coast ports, Figure 10 shows the landings of the five middle Texas coast ports, and Figure 11 shows the landings of the four lower Texas coast ports. The five upper Texas coast ports (with overall mean catch percentage) include Jefferson (9.1%), Chambers (0.9%), Galveston (3.1%), Harris (2.3%), and Kemah (7.6%). The five middle Texas coast ports (with overall mean catch percentage) include Port Lavaca (5.4%), Brazoria (9.5%), Matagorda (1.1%), Palacios (7.8%), and Seadrift (3.1%). The four lower Texas coast ports (with overall mean catch percentage) include Aransas (18.6%), Nueces (5.2%), Port Isabel (12.4%), and Brownsville (12.7%).

## 5. White Shrimp Catch off Texas

For the fourth consecutive year, the 0-4 fathom white shrimp fishery off Texas has been closed in conjunction with the Texas closure. During July 1990, following the first white shrimp closure, the majority of the white shrimp were in the <15 count range (Figure 12). This trend towards larger shrimp carried into August 1990, with the majority of the shrimp in the <30 count group (Figure 13). Following the 1991 closure, the majority of the shrimp in July were in the <20 count range, with a peak in production that had not been experienced in any other year since 1960. Landings of 1.0 million pounds of white shrimp taken in July off Texas was about 2 times greater than any previous recorded catch. The abundance of shrimp in August 1991 was still good, but landings during 1984, 1986 and 1990 were better (Figure 13). White shrimp in August 1991 were still quite large, with the majority <25 count. Following the 1992 closure, most white shrimp in July were again in the <20 count range, with a peak in landings second only to the level experienced in 1991. Abundance in August 1992 was quite high, but unlike the last two years most of the catch was composed of small sized shrimp (>41 count).

After the 1993 closure, the majority of white shrimp in July were again in the <20 count range, with a peak in production lower than experienced in both



1991 and 1992 (Figure 12). Abundance in August 1993 was extremely low when compared to all other years since 1980 (Figure 13).

Table 1. May - August catch of brown shrimp in millions of pounds from Louisiana (13-17) and Texas (18-21)

Area	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
<b>Louisiana</b>													
Inshore	10.2	11.6	6.5	15.9	11.3	14.0	12.4	14.3	8.9	14.9	12.1	15.1	15.2
Offshore	13.5	11.4	20.6	24.9	20.5	14.9	20.8	22.8	16.4	13.6	8.8	13.7	23.1
Total	23.7	23.0	27.1	40.8	31.0	28.9	33.2	37.1	25.7	28.5	20.9	28.8	38.3
<b>Texas</b>													
Inshore	6.1	4.3	7.8	7.4	6.1	6.9	7.6	5.1	5.4	7.1	5.9	4.1	4.2
Offshore	10.0	11.2	21.3	20.4	17.3	15.2	17.5	14.0	14.5	16.1	10.7	13.9	25.3
Total	16.1	15.5	29.1	27.8	23.4	22.1	25.1	19.1	19.9	23.5	16.4	18.0	29.5
<b>Offshore Only</b>													
<b>Louisiana</b>													
May-June	7.1	5.0	15.5	18.8	13.0	6.6	11.5	13.2	10.9	7.1	3.9	8.6	12.6
July	4.2	3.8	3.2	4.5	4.9	4.1	6.0	6.3	3.0	3.8	2.6	3.3	7.5
August	2.2	2.6	1.9	1.6	2.6	4.2	3.3	3.3	2.5	2.7	2.3	1.8	3.0
<b>Texas</b>													
May-June	0.8	0.5	1.2	0.8	1.0	2.7	3.3	3.3	0.6	0.8	0.7	0.8	0.4
July	5.2	6.4	12.7	11.9	7.3	7.5	8.9	5.7	8.3	8.8	5.2	6.6	10.4
August	4.1	4.3	7.4	7.7	9.0	5.0	5.3	5.0	5.6	6.5	4.8	6.5	14.5



Table 2. Summary of Offshore Fishing Effort and CPUE for Louisiana (13-17) and Texas (18-21)

Fishing Effort (1000 Days)						
	Area 13 - 17			Area 18 - 21		
	May - June	July	August	May - June	July	August
1981	14.8	8.1	3.8	1.1	4.4	10.4
1982	14.2	6.4	3.4	2.6	5.2	10.2
1983	9.1	4.2	4.9	2.3	3.7	6.7
1984	9.8	6.4	4.7	2.4	8.2	9.0
1985	11.1	6.0	3.7	1.5	6.8	8.4
1986	15.9	7.5	4.3	6.3	6.3	6.2
1987	19.0	10.0	5.8	7.7	9.8	8.2
1988	18.8	7.5	8.0	7.1	9.6	8.7
1989	28.5	8.2	2.8	3.8	5.7	10.2
1990	25.3	9.3	3.0	2.8	8.3	8.2
1991	34.7	4.1	3.9	2.5	8.2	7.6
1992	22.2	7.0	5.2	1.7	8.7	8.6
1993	25.0	6.6	4.9	2.4	7.1	8.2

CPUE (Pounds per Fishing Day)						
	Area 13 - 17			Area 18 - 21		
	May - June	July	August	May - June	July	August
1981	852	927	799	308	2,382	1,408
1982	607	525	522	295	1,279	629
1983	430	415	470	310	1,414	714
1984	718	598	573	295	1,074	723
1985	982	612	682	389	1,223	672
1986	830	840	773	524	896	799
1987	605	595	577	429	905	653
1988	351	556	521	538	781	578
1989	454	603	832	273	1,276	889
1990	749	473	517	298	1,426	937
1991	448	752	496	483	1,554	971
1992	226	535	497	343	728	499
1993	286	635	444	317	729	497

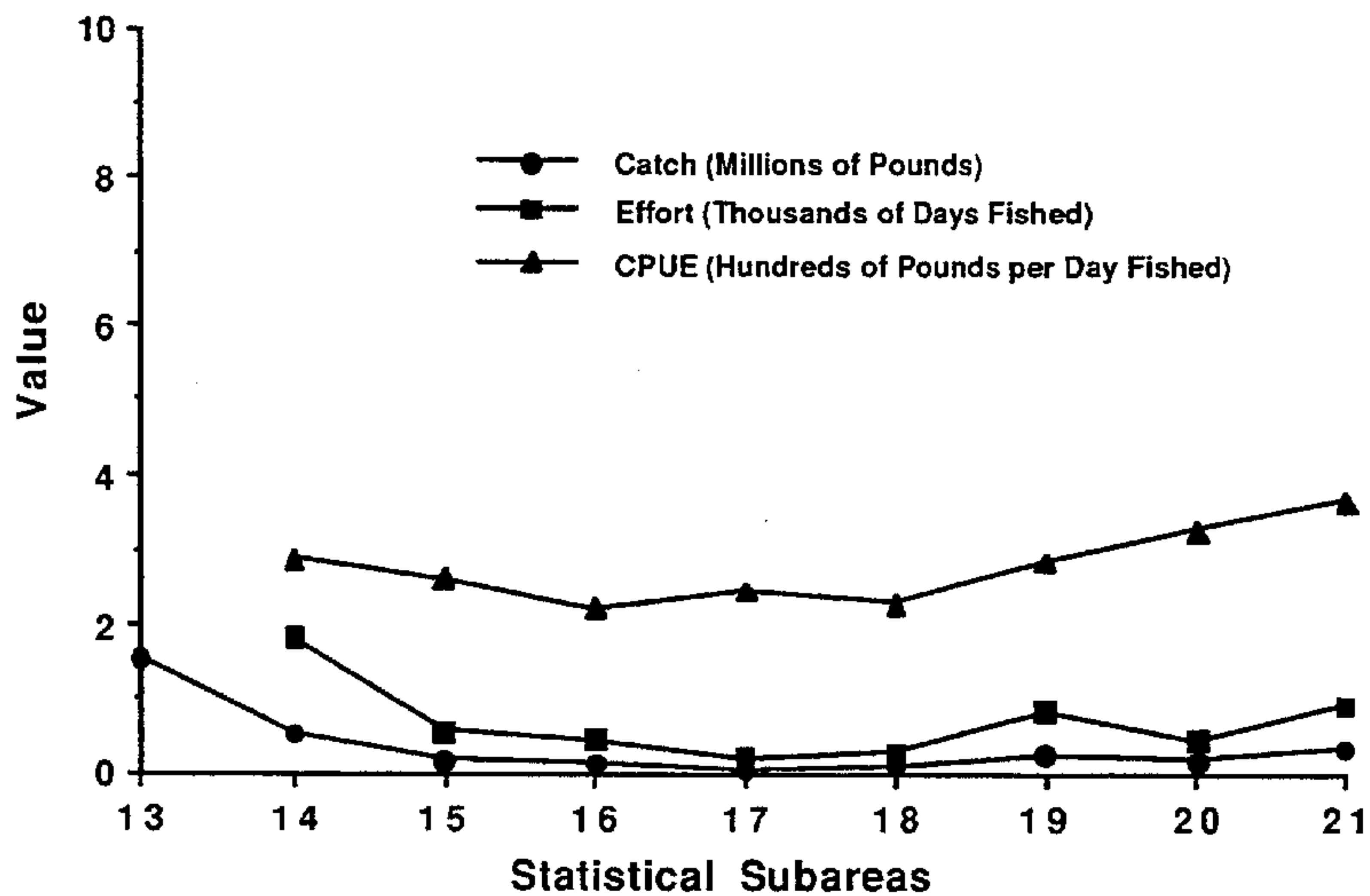
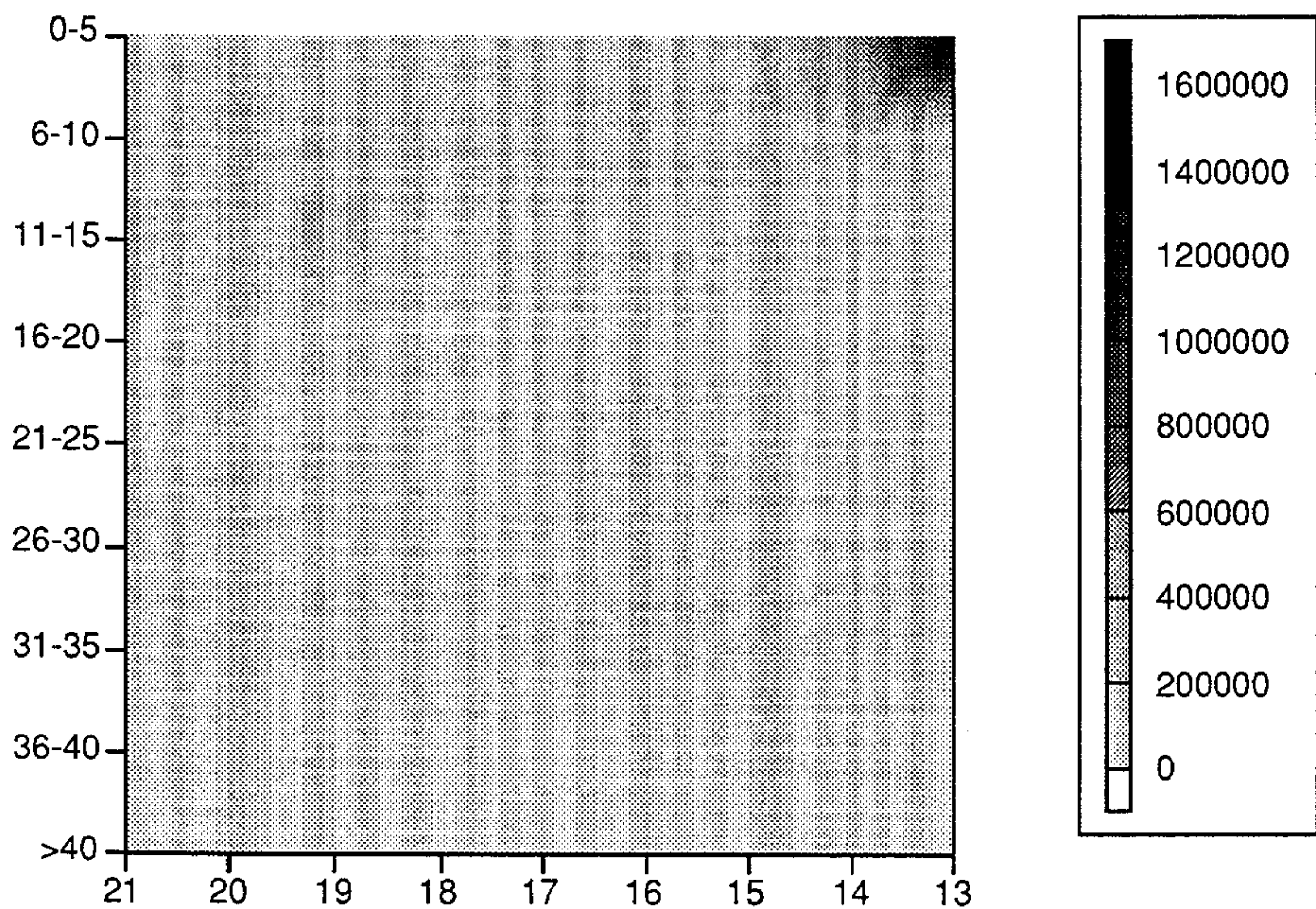


Figure 1. Offshore brown shrimp catch, effort and CPUE during May 1993.



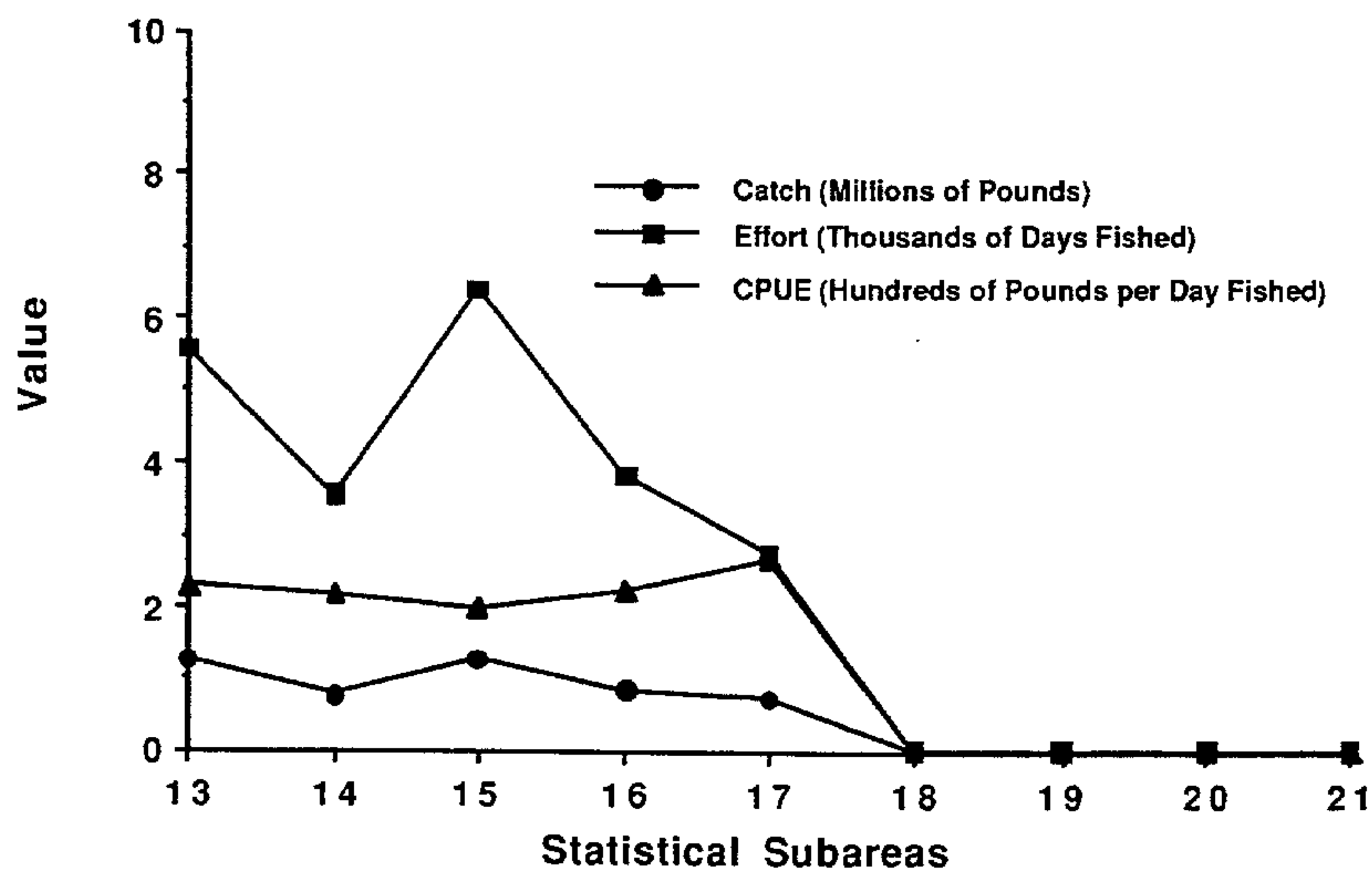
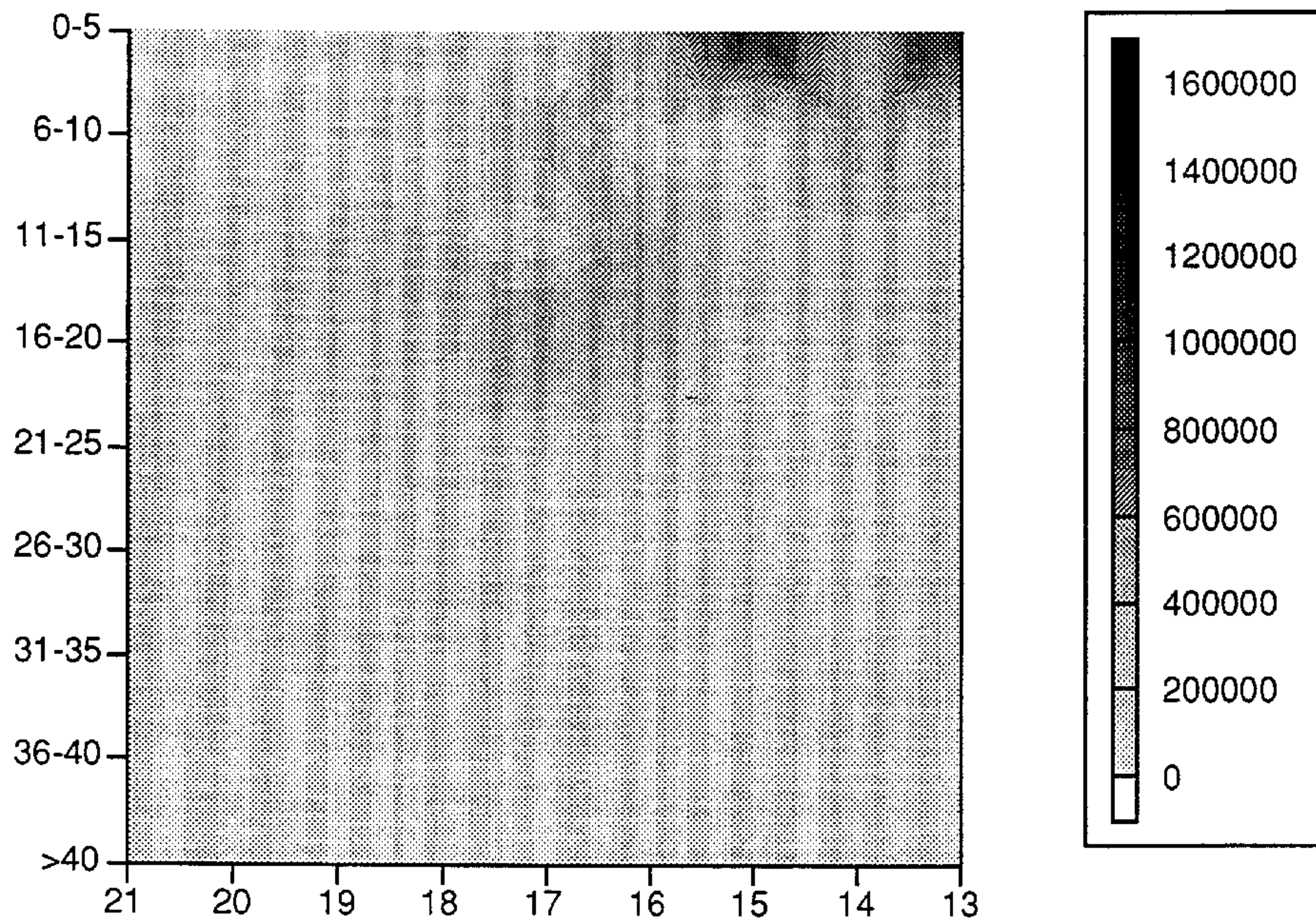


Figure 2. Offshore brown shrimp catch, effort and CPUE during June 1993.

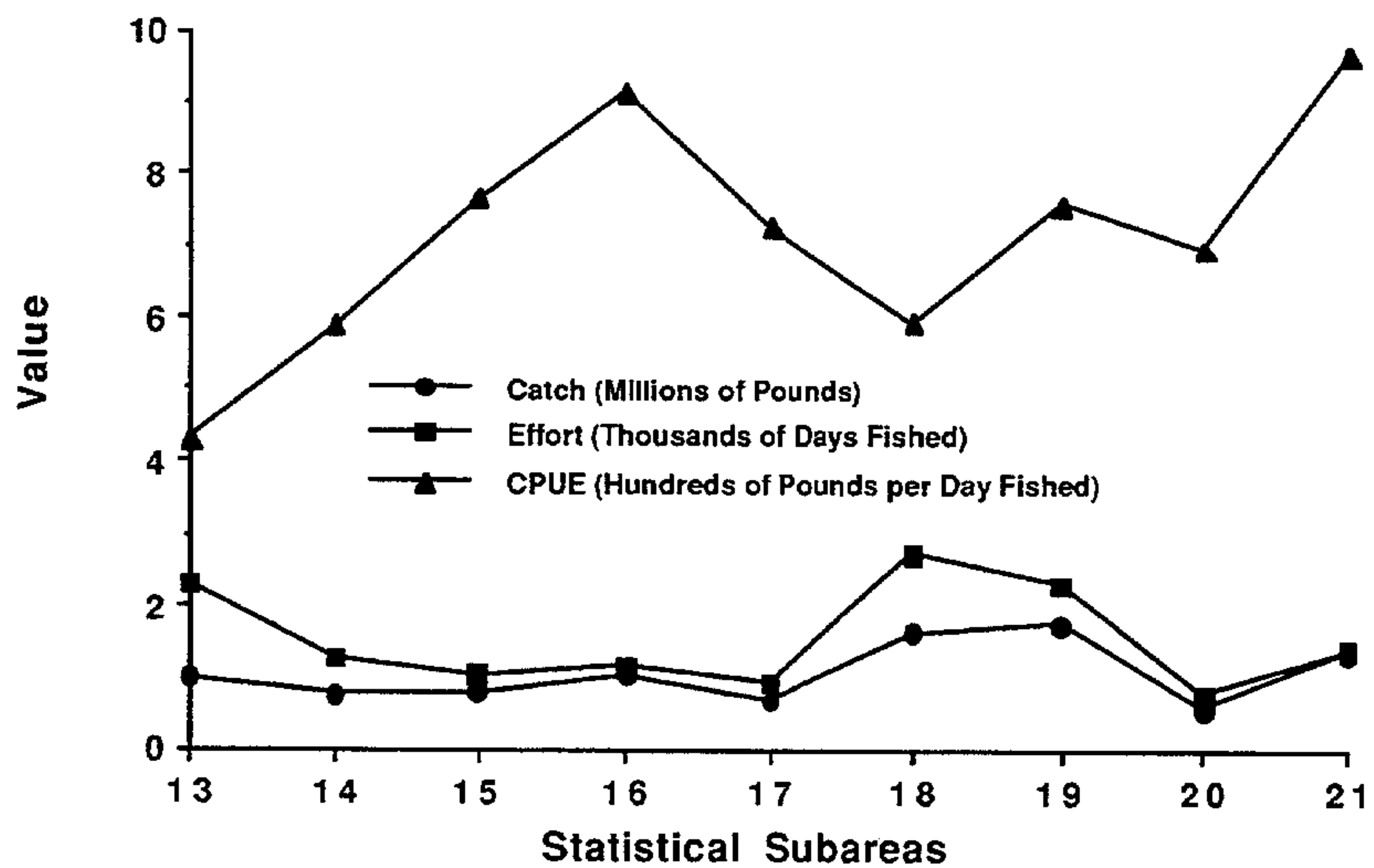
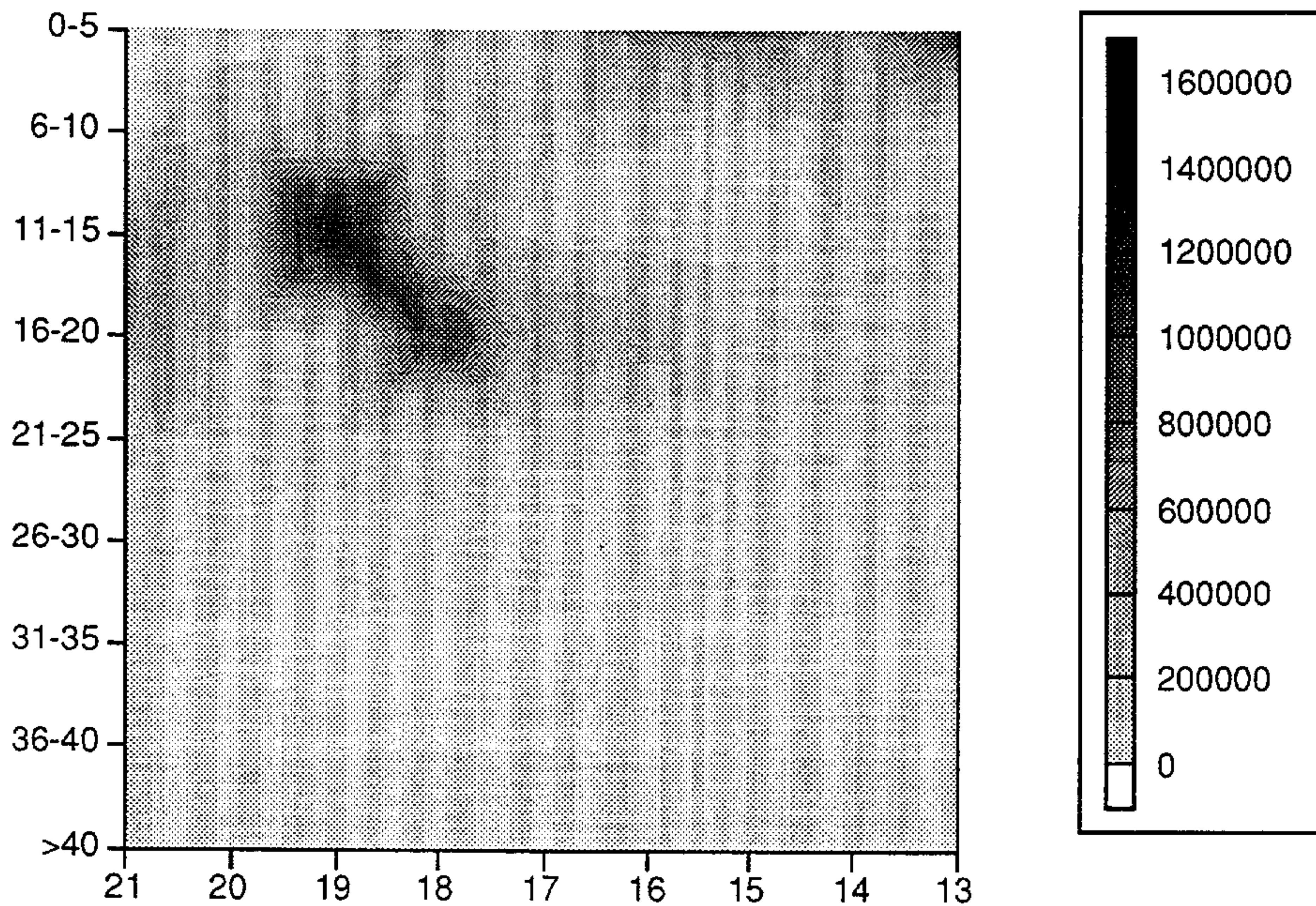


Figure 3. Offshore brown shrimp catch, effort and CPUE during July 1993.



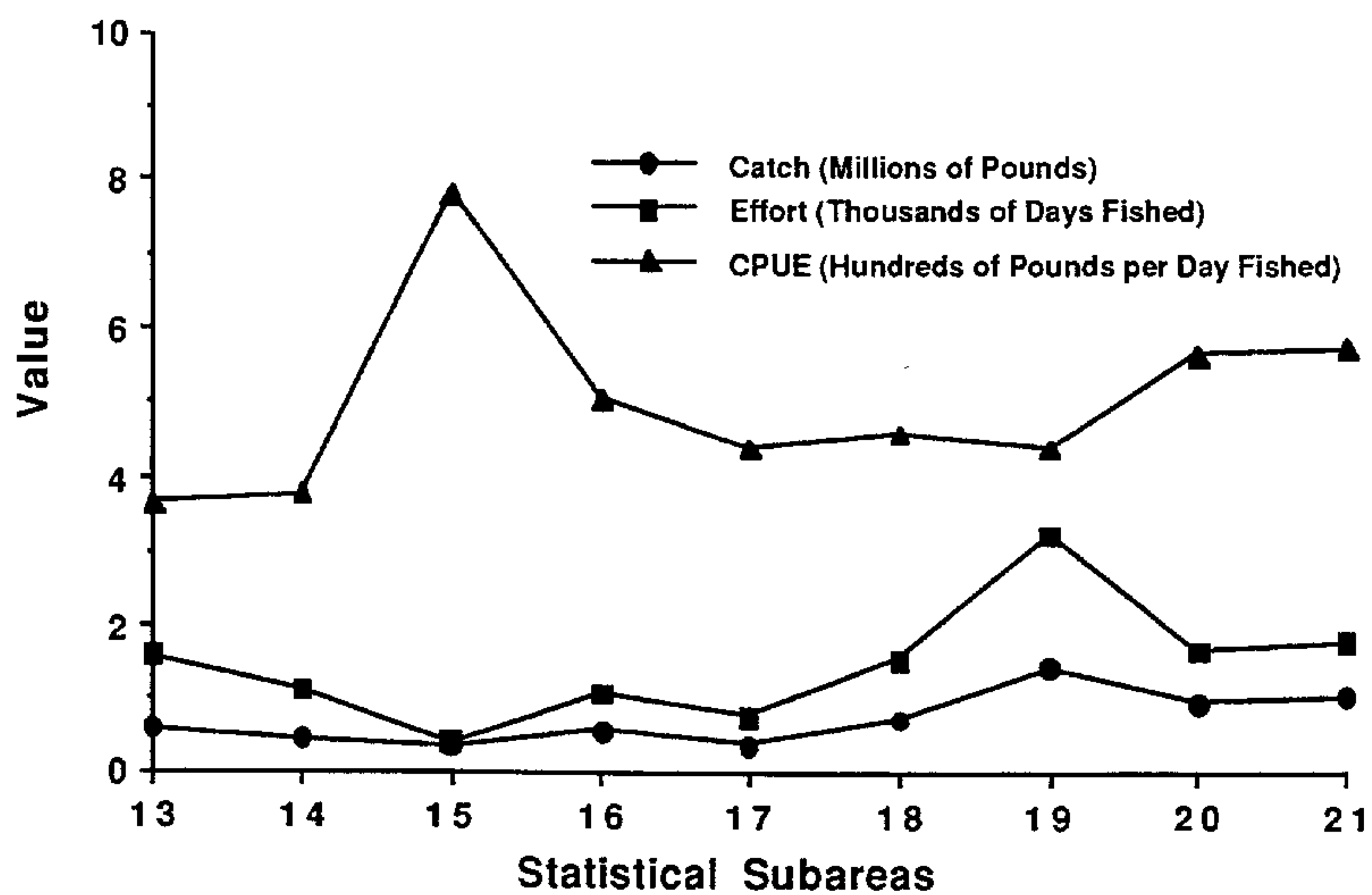
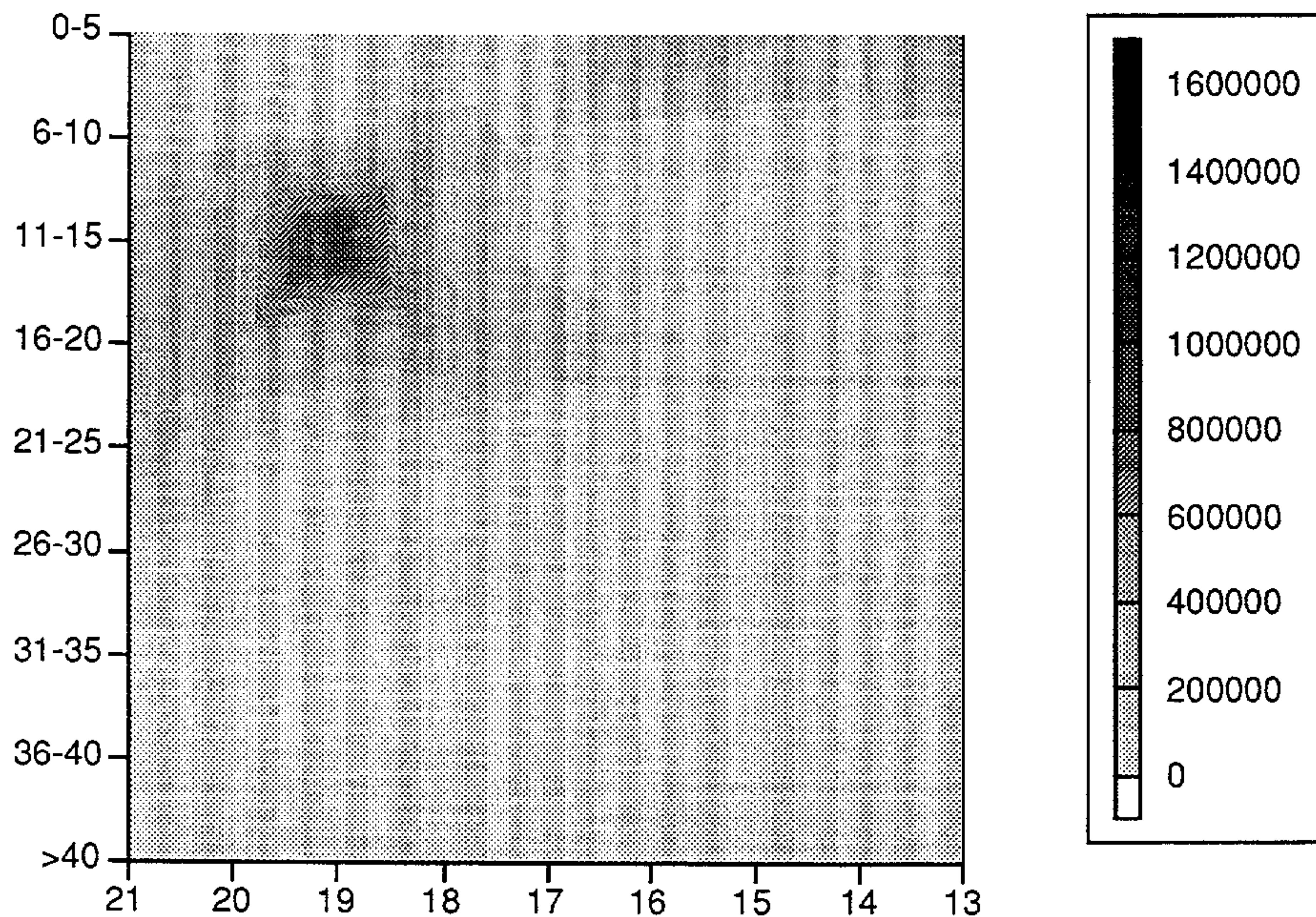


Figure 4. Offshore brown shrimp catch, effort and CPUE during August 1993.

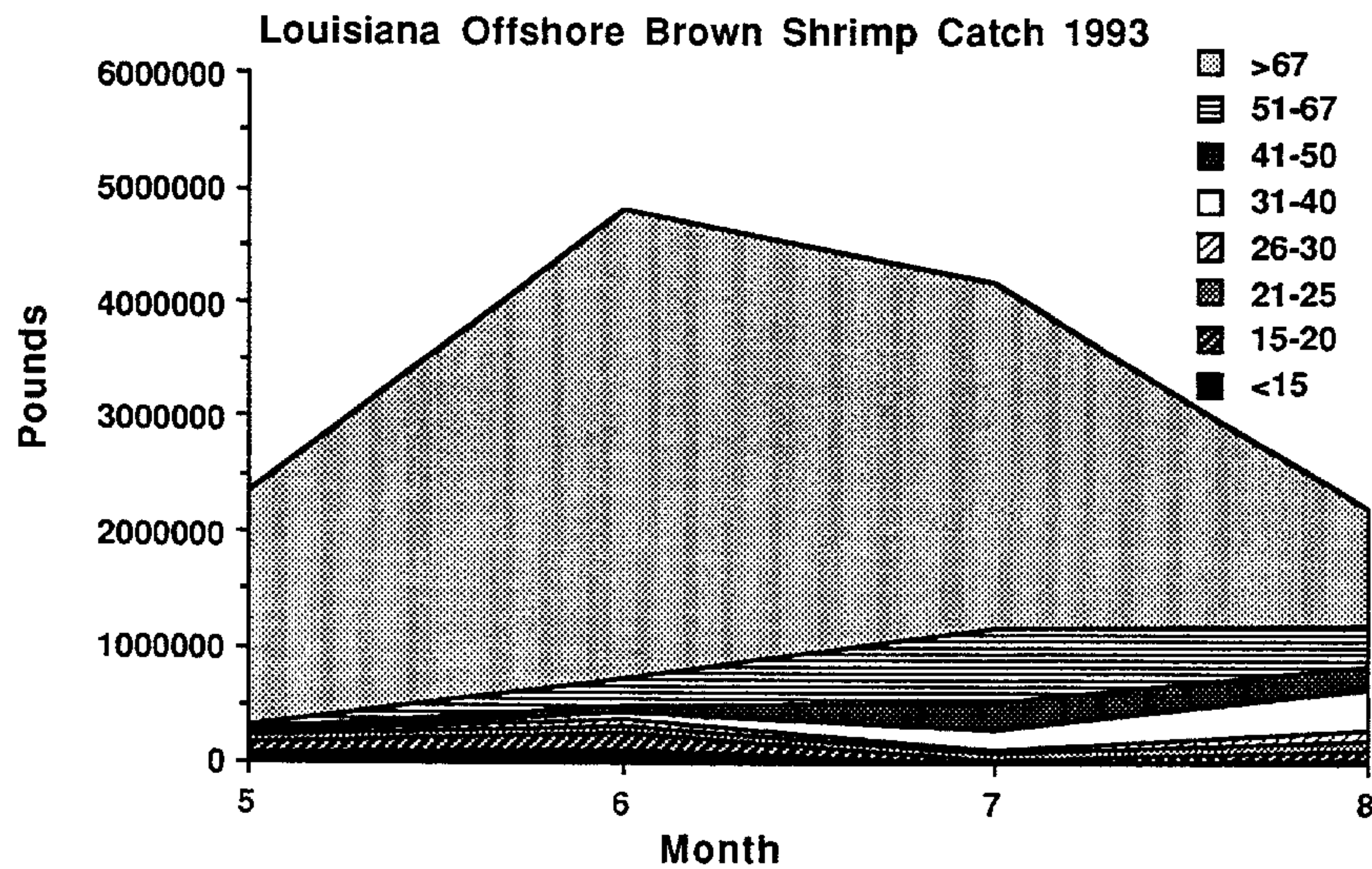


Figure 5. Size composition of brown shrimp taken from offshore Louisiana.



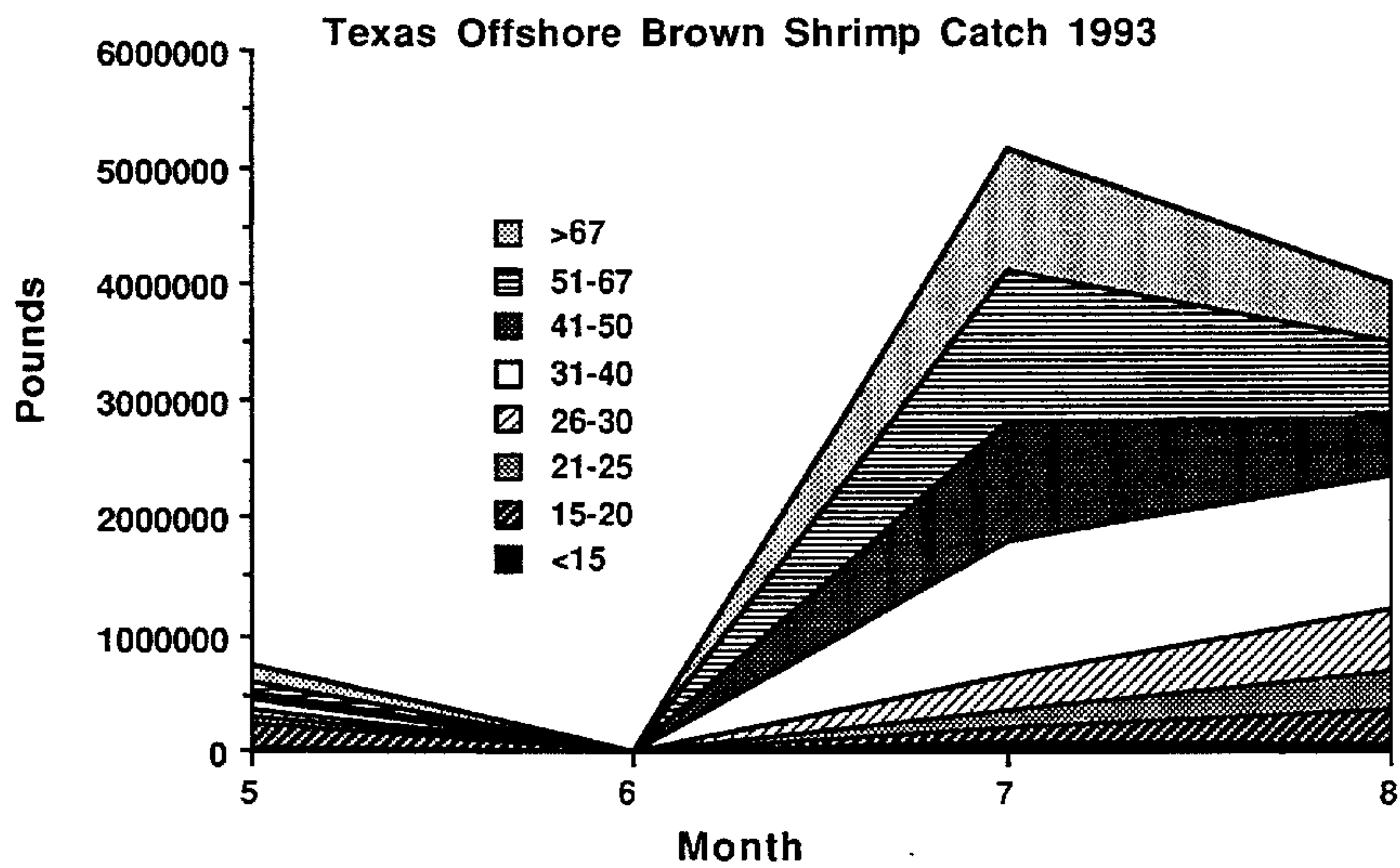


Figure 6. Size composition of brown shrimp taken from offshore Texas.

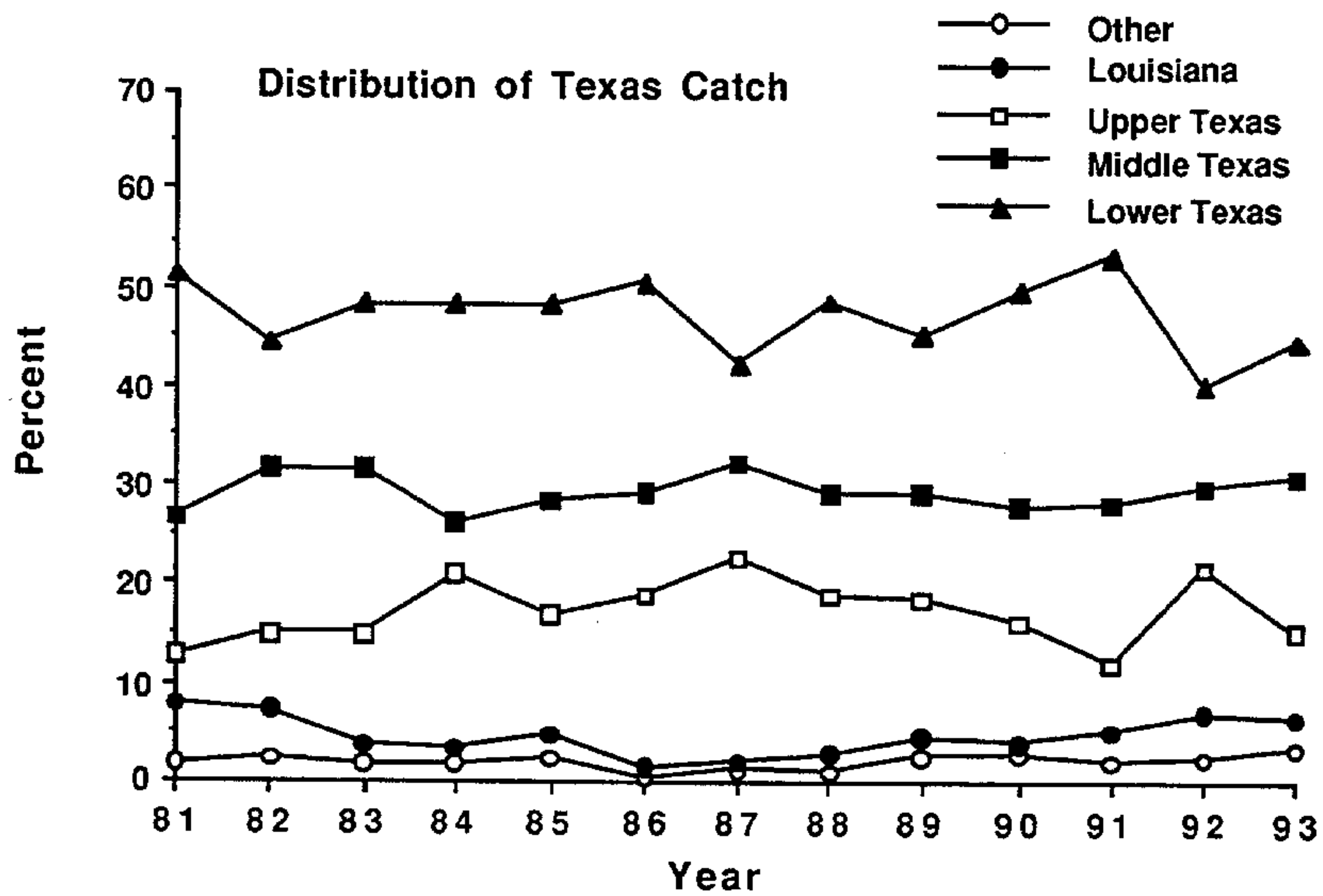


Figure 7. Distribution of May through August total shrimp catch from Texas waters, 1981 - 1993.

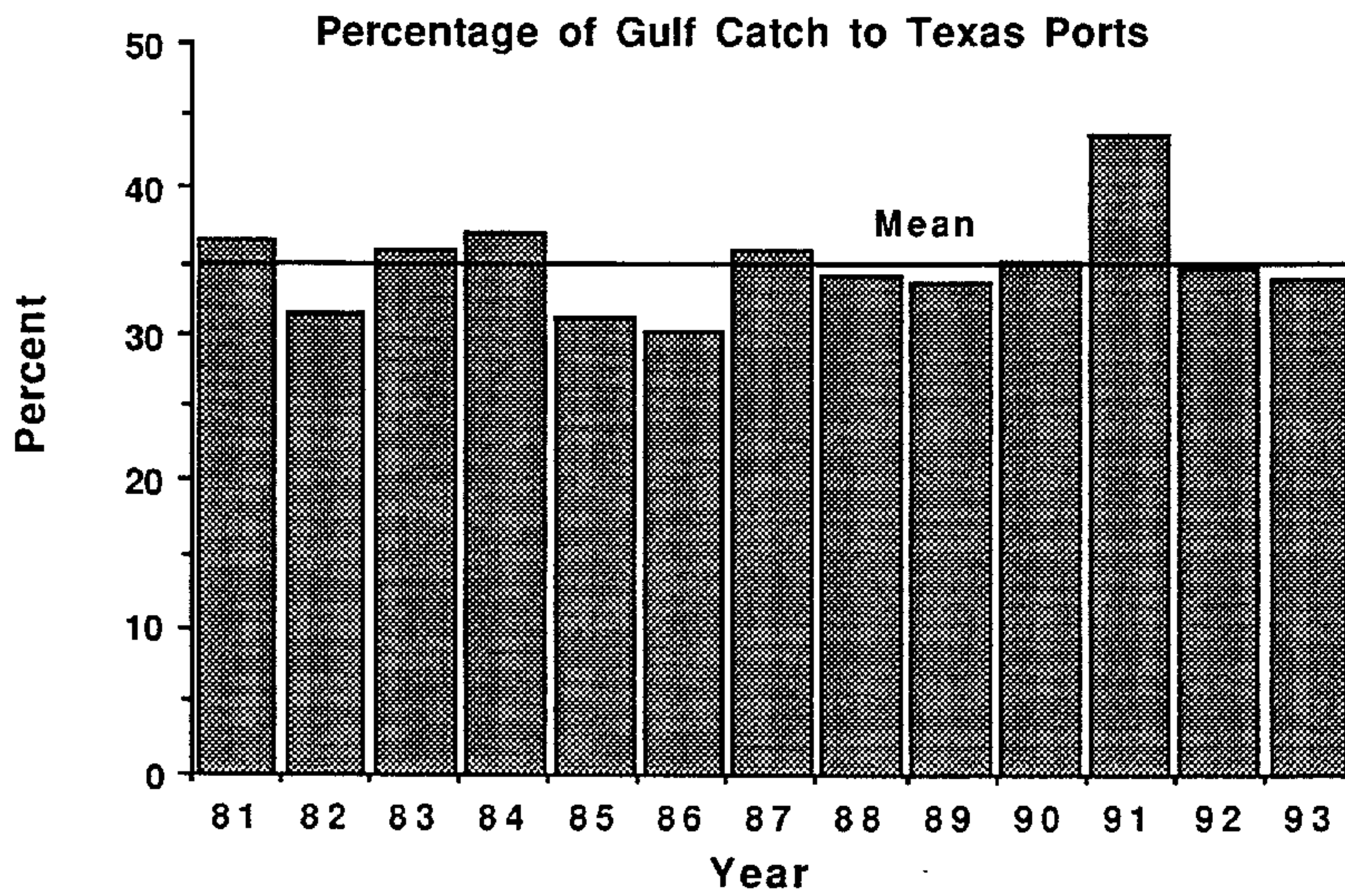


Figure 8. Distribution of May through August Gulf of Mexico shrimp production to all Texas ports, 1981 - 1993.



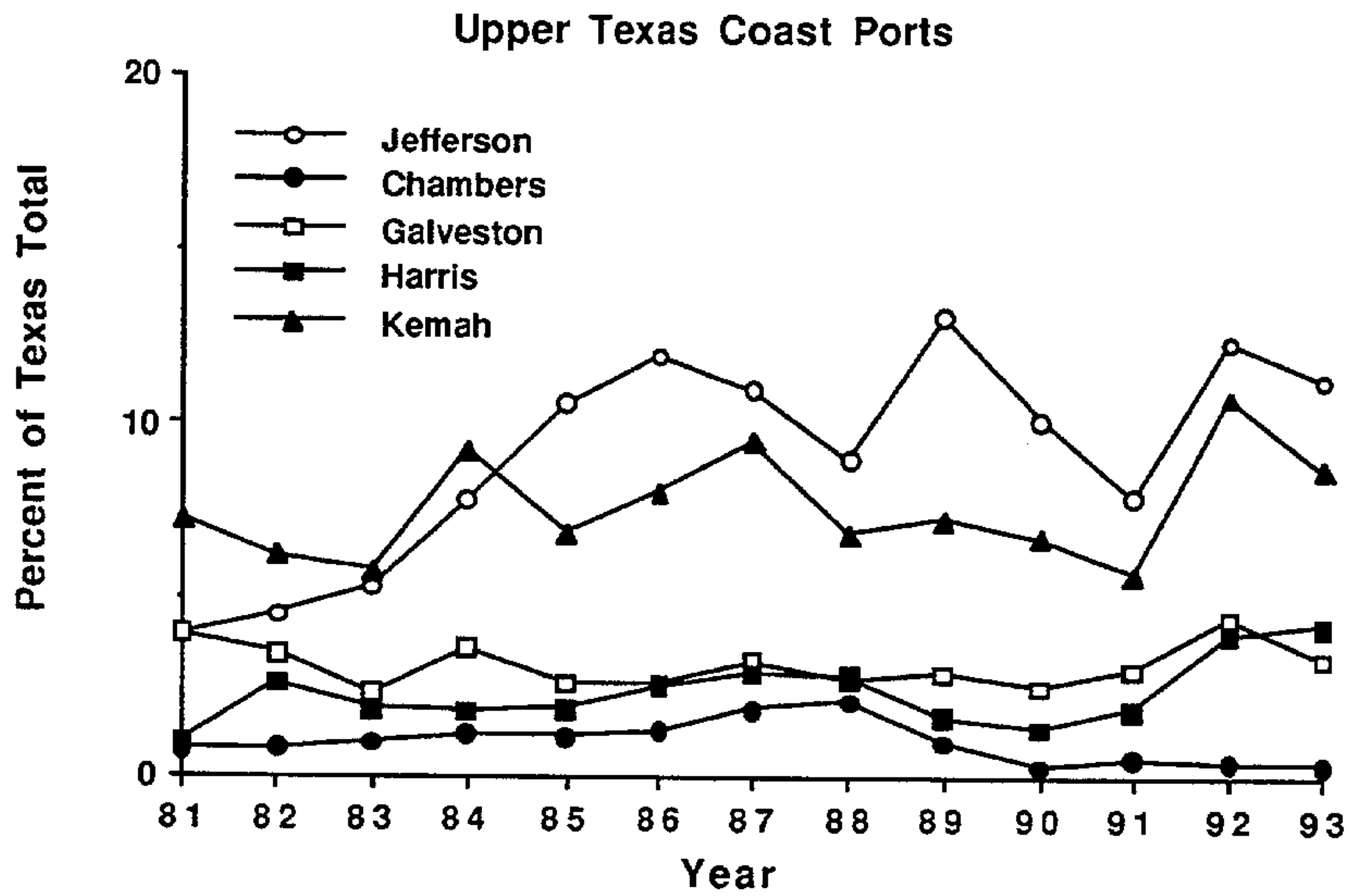


Figure 9. Distribution of May through August Texas landings by upper coast ports, 1981 - 1993.

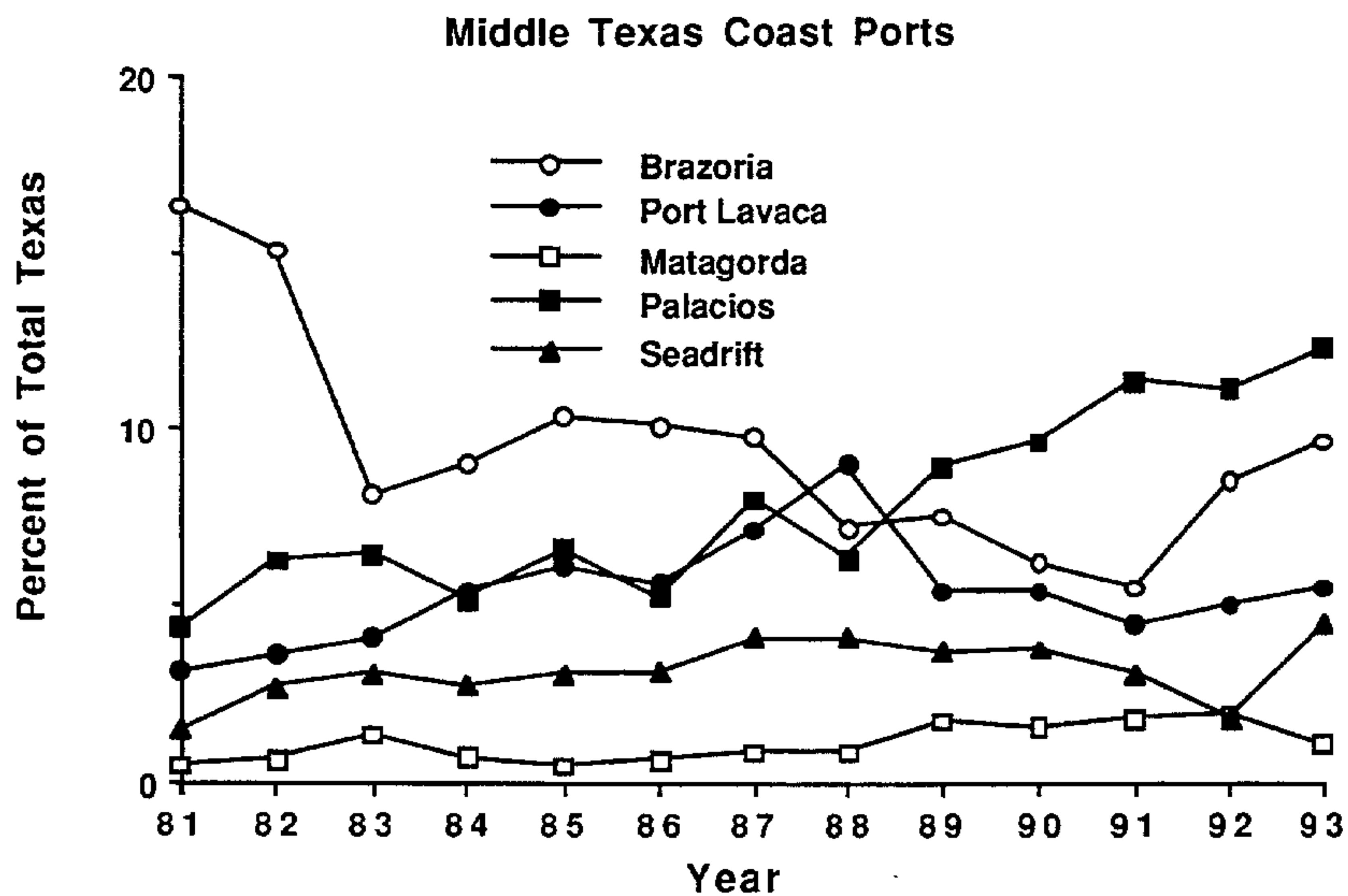


Figure 10. Distribution of May through August Texas landings by middle coast ports, 1981 - 1993.

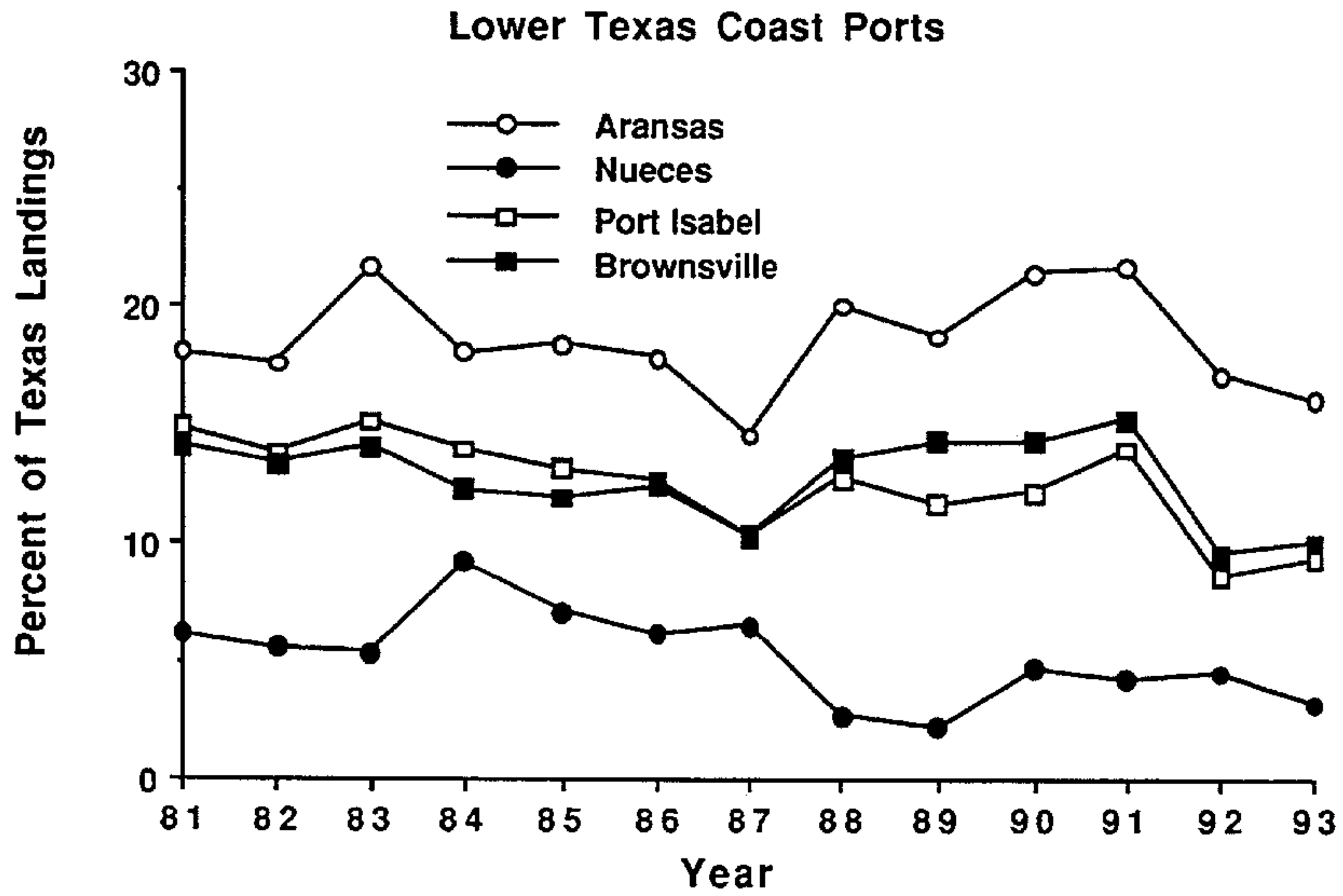


Figure 11. Distribution of May through August Texas landings by lower coast ports, 1981 - 1993.



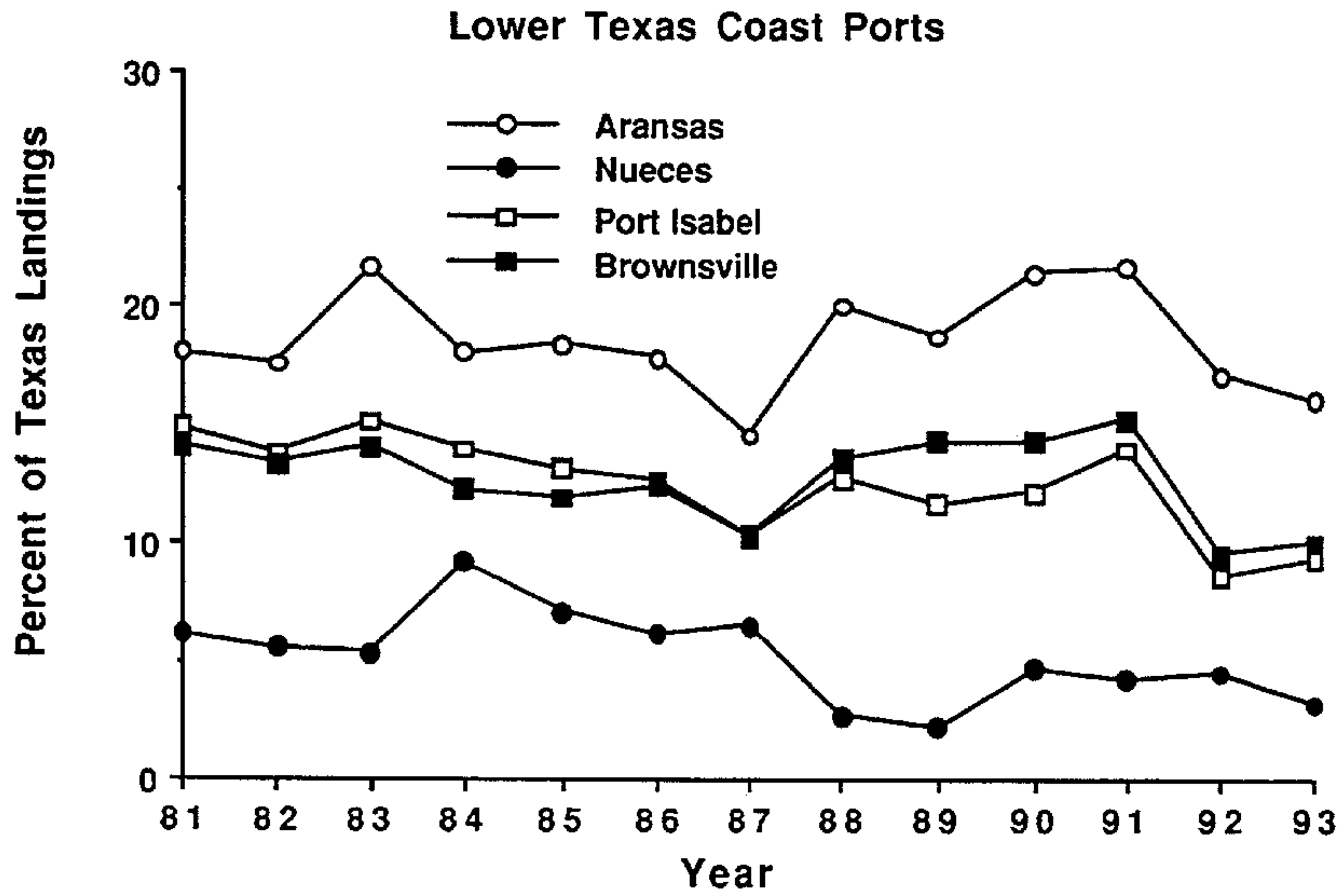


Figure 11. Distribution of May through August Texas landings by lower coast ports, 1981 - 1993.

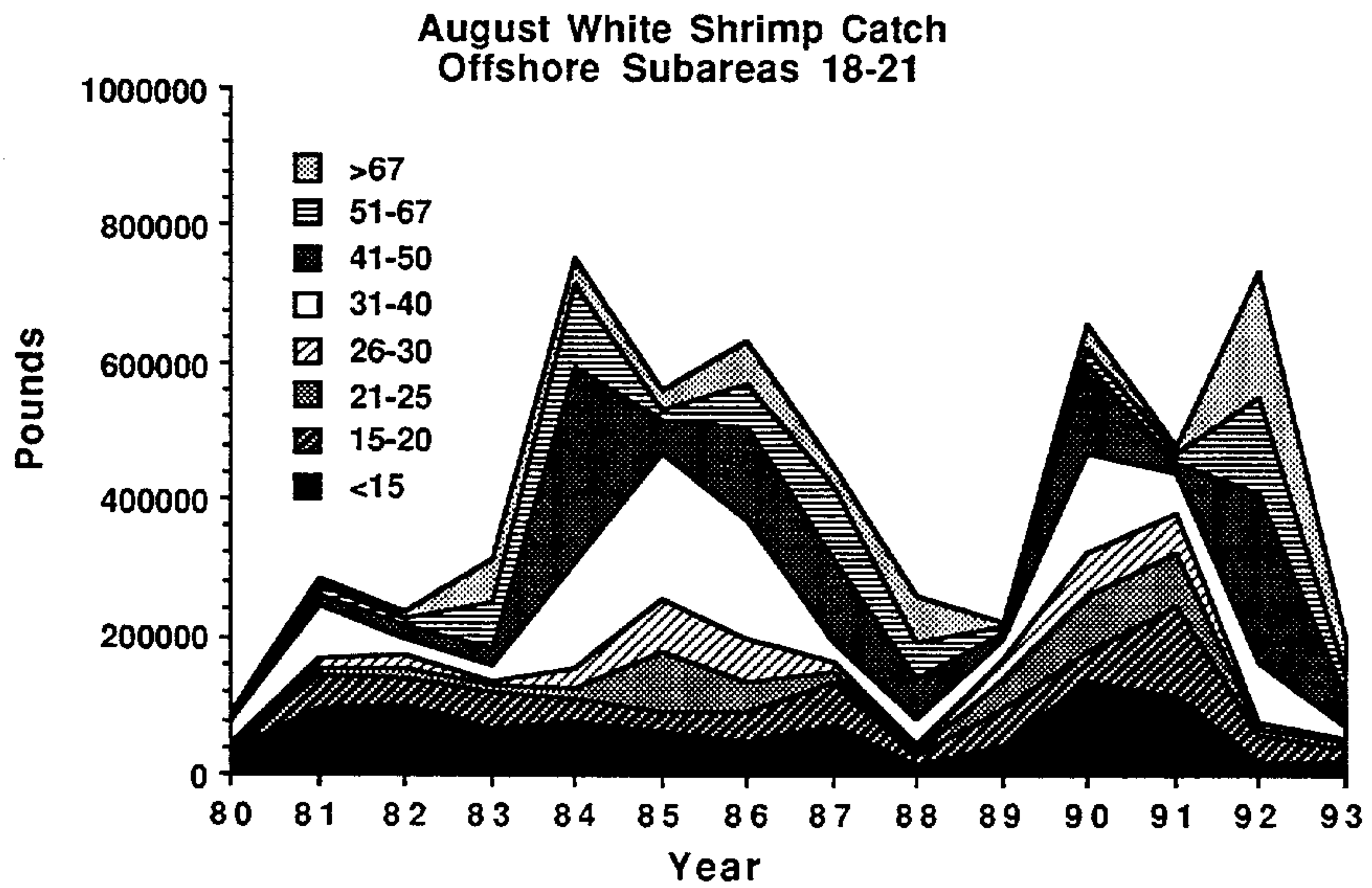


Figure 13. White shrimp size distribution off the Texas coast from 1980 - 1992 during August.